Research article

A practical study based on Complementarity Theory to explore the relationship between Knowledge Management Strategy and Organizational Performance

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Abstract

The purpose of this study is to verify the practical knowledge management strategies in Taiwan, yet the employed instrument was developed by Choi, Poon, and Davis (2008). The questionnaire had been translated into Chinese then surveyed via web. Total 94 samples selected from Taiwan public or private organizations. Structural equation modeling was used for data analysis. The reliability test result shows that instrument coefficients of reliability are .740~.940; composite reliability coefficient is .966. The Construct Validity coefficient is acceptable (convergence: λ>.55; discrimination: χ^2=7.29~10.69). Some indicators were passed the criteria (CMIN/DF, PGFI, NFI, NNFI, IFI, and CFI). The examination results of Complementarity model shows that only "internal knowledge-oriented strategy" was associated with corporate performance (ß=4.68; p<.05), the conclusions and suggestions were presented dependent on research result and finding.
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Keywords: knowledge management, complementarity theory, organizational performance, structural equation
modeling

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I. Introduction
1.1 Motivation

It is generally believed that knowledge is one of the most important resources for an organization and also that effective knowledge management can always help it maintain a competitive advantage over others. Therefore, the skillful use of knowledge throughout an organization is definitely a valuable asset, enabling the corporation to effectively meet the daily challenge from the competition. It has become evident that more and more companies are willing to invest more in the strengthening of knowledge management and the establishment of an effective system to better obtain and use their resources (Sarvary, 1999).

Basic research on the terminology "Knowledge Management Strategy" has been done by numerous organizations (Earl, 2001; Hansen, 1999). The two dimensions of knowledge management strategy are the focuses, and the resources. The focuses basically involve two areas: Explicit Knowledge and Tacit Knowledge. With a clear and effective strategy, cooperate performance improvement can be achieved by embedding knowledge management in everyday work (Hansen, 1999). The implementation of Tacit Oriented Knowledge, however, needs to be custom designed based on different levels of workers' socialization by observing the face-to-face communication and interaction with them (Zack, 1999a). The sources of knowledge, in terms of corporate strategy, can be divided into two areas: Internal Knowledge and External Knowledge. (Bierly, 1996; Zack, 1999b) External oriented knowledge basically comes from outside the organization, by way of acquisition, duplication and eventually transfers (Lee, Chang & Choi, 1999) while the internal oriented knowledge emphasizes on the creation and sharing of it within the organization.

In his book "*Managing in the Next Society*", Drucker (2002), the master in management, says "*The next

society will be a society of knowledge. Knowledge is a resource and knowledge workers will soon become the mainstream of workforce. The workers in the near future will be composed of two basic groups: Knowledge Workers and Non-knowledge Workers, with their compensation, behavior and work totally different from each other....As far as multi-national companies are concerned, there is only one economy: the Globe" (p.321) that clearly describes the importance of role that "knowledge" plays in the modern day economic development. The inevitable and unstoppable trend has turned to "knowledge oriented" this time regardless of your business. A company's profit will no longer rely on its tangible assets but on the acquisition and application of its most precious intangible asset, the knowledge. Without doubt knowledge has become the key issue in surviving the competition, which naturally makes knowledge management a vital course in organization management strategy (Allee, 1997).

Knowledge Management and Innovation are essential in this knowledge-driven times. He who owns knowledge will have the ability and opportunity for innovation. (Hitt, Hoskinson & Kim, 1997). It's now an imminent task for an organization to know how to obtain, codify, diffuse and store knowledge; how to make the process of knowledge fit in the organization structure and how to sustain and explore the opportunity for new creativity (Hoffmann, Loser, Walter & Herrmann, 1999).

With reference to the correlation of 'knowledge management' with 'corporate performance', a systematic knowledge management strategy is often created to store knowledge in database (Hansen, 1999). A further study on Taiwan electronics industry reveals that most companies can tightly attribute their productivity, creativity, commercialization of ideas and consequently, the effectiveness of the organization as a whole, to the management of their database. (Lin, 2001). Finally, the lack of literature on Complementarity Theory Approach on Corporate Performance (Choi, Poon & Davis, 2008) is also an important factor that prompts us to believe the importance of and to study such area.

1.2 Purposes

Based on our motivation, this study aims to probe the effect of Knowledge Management Strategy on Corporation Performance based on Complementarity theory-based approach. There are two facets:

1. Explore the interrelation between "Knowledge Management Strategy" and "Corporate Performance".

2. Examine the framework to determine the effect of Knowledge Management on Corporate Performance based on Complementarity theory.

2. Theoretical Background

2.1 Organization performance

The ultimate purpose of an organization's strategy and endeavor is to raise its effectiveness. The three guidelines to measure performance are: Financial Effectiveness, Business Effectiveness and Organization Effectiveness (Venkatraman & Ramanujan, 1986). Among them, organization effectiveness is widely used in areas such as strategic management and organization theory. Two guidelines are generally used to evaluate the organization performance. First is "Univariate Effectiveness Measure" which includes productivity, organization growth, net profit and objective achievement etc. Not all aspects of operation and performance are covered in

this measure. On the other hand, "Multivariate Effectiveness Measure" tends to be a more comprehensive method. Researchers in this field have provided guidelines to determine the organizational performance as in Table 1.

Table 1: Summary of Organization Performance Indicators

Authors	Organization Performance Indicators
Delaney & Huselid (1996)	1. Cognitive Organization Performance: Quality of goods and services, Development of new products and services, Ability to attract talents, Customer satisfaction, Management-worker relation, relation among the co-workers. 2. Cognitive market performance: Revenue growth, Market share, Profitability and Sales promotion.
Miler (1990)	1. Rate of Return on Investment; 2. Cash Flow on Investment; 3. Market Share; 4. Stability of Market Share; 5. Profit Margin; 6. Employee Productivity.
Venkatraman & Ramanujam (1986)	1. Financial effectiveness: Profit Margin, Revenue Growth. 2. Business effectiveness: Market Share, Product Quality, Introduction of New Products. 3. Organization Efficiency.
Lin (1995)	1. Rate of Return on Investment; 2. Profit Margin; 3. Staff Morale; 4. Employee Productivity.
Xu (1995)	1. Revenue Growth Rate; 2. Net Profit Growth Rate; 3. Creativity; 4. Employee Turnover Rate; 5. Output per Worker.
Chen (1998)	1. Rate of Return on Assets; 2. Revenue Growth Rate; 3. Profitability; 4. Staff Morale; 5. Productivity; 6. Product Quality; 7. Inventory Turnover Rate.
Jaw (1994)	1. Staff morale; 2. Absenteeism; 3. Employee Turnover Rate; 4. Productivity; 5. Attraction of Professionals; 6. Senior Manpower Management; 7. Revenue Growth Rate.

Note: Adopted from Chang (2001).

Miler (1990) tries to determine the organization effectiveness using six guidelines: 1. rate of return on investment; 2. cash flow on investment; 3. market share; 4. stability of market share; 5. profit margin; 6. employee productivity while Delany and Huselid (1996) take a cognitive approach. This research uses four guidelines commonly adopted by the above-mentioned researchers. They are Market Share (Venkatraman & Ramanujam, 1986; Miler 1990, Delany & Huselid, 1996), Growth Rate (Jaw, 1994; Xu, 1995; Chen, 1998), Profitability (Venkatraman & Ramanujam, 1986; Delany & Huselid, 1996; Lin, 1995; Chen, 998), and Creativity (Xu, 1995).

2.2 Knowledge Management Strategy

2.2.1 Knowledge Management

Drucker (1993) suggests that Knowledge Management should lay its focus on knowledge. Management's ultimate goal is a systematic and organized application of knowledge to knowledge. Knowledge is power, yet most enterprises fail to realize its true meaning. Knowledge Management is making sustained efforts to manage knowledge, to label and use existing information/data, and consequently, to create new opportunities (Quintas, 1997). Therefore, the goal of Knowledge Management is to add value for the organization through the effective use of existing knowledge. Four Conversion Stages are shown in the process of new knowledge creation (Nonaka & Takeuchi, 1995) as in the following Figure 1.
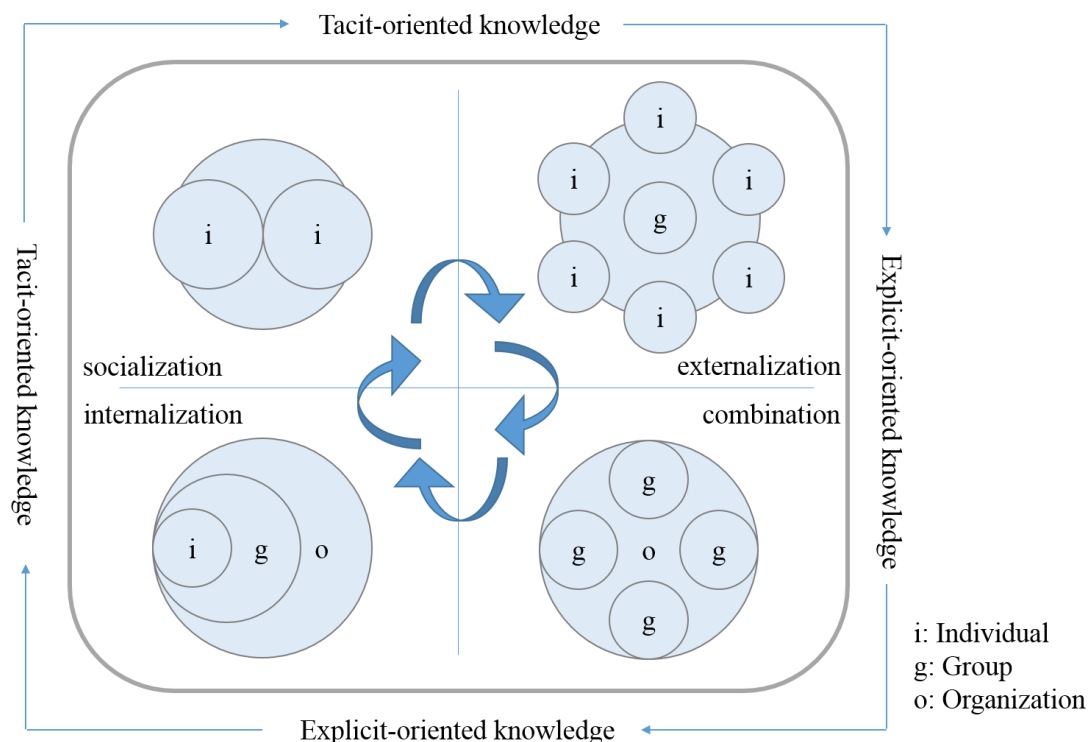
Figure 1. Knowledge Conversion Spiral and Self-Transcendence (SECI Model)

Resource: Nonaka, I., & Konno, N. (1998).

(1) Tacit to Tacit (Socialization)

This dimension of social interaction explains the knowledge transfer among members through shared experience, mentality and technical skills.

(2) Tacit to Explicit: (Externalization)

This mode involves the transition of tacit knowledge to explicit knowledge through the process of externalization which includes the use of metaphor, comparison and concept.

(3) Explicit to Explicit (Combination)

This is a process to combine and organize various types of concept and knowledge. The mode involves the integration of different types of knowledge system such as school education.

(4) Explicit to Tacit (Internalization)

This phase is a process to convert explicit knowledge back to tacit knowledge. The experience received and organized will go through phases of socialization, externalization, combination and finally internalization, making it part of individual knowledge, thus a valuable asset for the organization.

2.2.2. Knowledge Management Strategy

The task of knowledge management consists of the establishment of a complete and smart database, and the creation of an organization environment for knowledge sharing (Stewart, 1997). Organization knowledge is therefore applied to achieve its mission (O'Dell & Grayson, 1998). Knowledge management is a strategy that

ensures the right knowledge is sent to the right person at the right time.   It helps people share knowledge and then put it into practical use for better corporation performance.   Organization needs to adopt a specific knowledge management strategy suitable for its specific structural framework. This is to ensure that the knowledge is properly stored, updated and equally emphasized in quality and quantity. Most organizations have become aware of the fact that, in order to maintain a competitive edge, a no-nonsense policy on knowledge management is essential. Yet they know little about the importance of the integration of knowledge management with their business strategy. Tarn (2001) contends that knowledge management should follow knowledge management strategy. An organization will be disoriented without a strategy on knowledge management.

Choi et al. (2008) and other researchers propose the four dimensions of knowledge management strategy in their research analysis as follows:

(1) Knowledge Management Strategy: Explicit-oriented Degree.

This dimension aims to study the codifying, storing and retrieval of knowledge.   Focus is on the evaluation of knowledge classification and formatting process with reference to knowledge codification, knowledge acquisition and knowledge sharing.

(2) Knowledge Management Strategy: Tacit-oriented Degree.

This dimension tends to study the acquisition and sharing process of tacit-oriented knowledge through interaction among the workers. It also intends to evaluate the impact of assistance from professionals and colleagues and/or the face-to-face communication with them, one on one dialog, in relation to the degree of tacit knowledge acquiring and sharing.

(3) Knowledge Management Strategy: External-oriented.

This dimension aims at the study of the situations to obtain knowledge outside the organization for the purpose of developing new knowledge (new knowledge on products and services)   Commonly known sources of   external-oriented knowledge include publication, consultation, cross-organizational alliances, competitors, customers and pay knowledge purchased from knowledge dealers.   The strategy studies and evaluates the knowledge gained outside the organization, usually from customers and other collaborators. The conditions of competitors' knowledge are also included in the study.

(4) Knowledge Management Strategy: Internal-oriented.

This dimension features the development of new knowledge (new knowledge on products and services) derived from internal knowledge. Internal knowledge may exist in software and equipment, in workers mind and may be reflected in their behavior.   The study is also designed to evaluate the organization interpretation of internal knowledge in terms of its importance, trustworthiness, usefulness, superiority, perception on quantity and quality, and finally the usage rate of it.

2.3 Complementarity Theory

The pioneer concept of complementarity was first brought forward by Edgeworth (1881). He defines "action" as being "complementary". An "action" will no doubt attract or cause a "feedback" to it. Milgram and Roberts (1990, 1995) propose an idea that organizational activities and training are closely complementary to each other in a process of association and adaption, thus increasing each individual's contribution.   The

comprehensive impact of complementary effect will be greater if the series of activities are held on a large and massive scale than a single small activity (Choi et al, 2008).

Many researchers have conducted study on the complementary relation in numerous business activities. Black and Lynch (2001) try to analyze the impact of workplace on productivity. Bresnahan, Brynjolfsson, and Lorin (2002) investigate data regarding the organization structure (in the area of decision-making, labor union and dividend distribution) and human capital of 400 large corporations. They have concluded that the tasks involved are interrelated in their nature. Their connection will then evolve the concept of complementarity. The complementary concept is instrumental in explaining the complex connection between knowledge management strategy and tasks. Bresnaban and others have compiled the aspects on knowledge management strategy into two major categories as shown in Table 2.

Table 2: Summary of Analysis on Knowledge Management Strategy and Complementary Theory

Authors	Types of Knowledge Management Strategy	Organization Performance	Proposed Strategy	Research Methods	Conclusions
Bierly & Chakrbarti (1996)	Independents, Pioneers, Explorers, Performers	Profit on Sales, Profit on Assets	Reformers, Explorers	Experience	Higher profit is related to the complementary theory in knowledge management strategy. (Performers and Explorers)
Choi & Lee(2003)	Passive, System-oriented, Human-oriented, Dynamic	Overall Success, Market Share, Innovation, Growth Rate, Size of Organization	Dynamic	Experience	Better performance is expected by adopting complementarity theory(a strategy to integrate human factors with systems)
Zack (1999a)	Conservative, Active-	N/A	Active	Conceptual	Complementarity theory (active knowledge management strategy) for better performance

Resource: Choi, Poon & Davis (2008).

The researchers clearly denote the relation between Complementarity and Knowledge Management Strategy. A standard and comprehensive knowledge management strategy is suggested for the purpose of improving efficiency. Individual knowledge management strategy should not be considered to avoid insufficient improvement and less efficiency. Bierly and Chakrabarti (1996) find it obvious that the application of complementarity theory (tacit-oriented and explicit-oriented strategy) helps increase return on sales (ROS) and return on assets (ROA). Choi and Lee (2003) confirm the fact that better performance for organizations usually result from a sound tacit-oriented and explicit-oriented strategy. Zack (1999b) regards the "active knowledge management strategy" an effective tool to better the organizational performance by way of integrating the internalization of tacit knowledge with the externalization of the explicit knowledge.

The second category deals with the Non-complementary perspective in knowledge management. As shown in Table 3, the research centers on the inability to guarantee a rise in organizational performance, even a comprehensive knowledge strategy is adopted. Hansen et al. (1999) stress the importance for any organization to

implement the codification of explicit-oriented knowledge and the individualization of tacit-oriented knowledge. Unfortunately, the two types of knowledge cannot co-exist as effective tools. Keskin (2005), on the other hand, thinks that the explicit-oriented knowledge plays a more important role in organizations than tacit-oriented knowledge. Pai (2005) thinks that all innovators, who are the link between tacit-oriented knowledge and explicit-oriented knowledge, tend to have a worse performance. Schulz and Jobe (2001) suggest that, with regard to performance, a single knowledge management strategy is better than a mixed one. Swan et al. (2002) stress that a tacit-oriented strategy is better than an explicit-oriented one.

Table 3: Summary of Knowledge Management Strategy and Non- complementary theory

Authors	Types of knowledge management strategy	Organization Performance-	Suggested Strategy	Research Methods	Conclusions
Hansen et al. (1999)	Regualtions, Individual	N/A	80-20 division	Conceptual	Both explicit-oriented and tacit-oriented knowledge help the performance.
Keskin (2005)	Clear-oriented, Silent-oriented-	Overall success, Market share, Innovation, Growth, Size of organization	Clear	Experience	An organization performs better with a clear-oriented knowledge management strategy than with a silent-oriented one.
Pai (2005)	Founder, Outside learner, Internal pioneer, Overall creator	Profit on asset, Profit from stock	Internal pioneer	Experience	The performance of advocates (of tacit and explicit knowledge theory) is poorer than internal pioneers.
Schulz & Jobe (2001)	Regualtions, Implicit consent, Focus, Off-focus	Overall performance in the last five years	Focus	Experience	Centralized policy is better than all other ones.
Swan et al. (2000)	Cognitive, Public	N/A	Public	Conceptual	Public strategy (silent-oriented) is expected to perform better than cognitive strategy (clear-oriented).

Resource: Choi, Poon & Davis (2008).

Some interesting theories can be developed by summarizing the work of these researchers. First, the focus and sources are the two facets of knowledge management strategy. For example, Hansen and others (1999) bring forward the codification of knowledge. Keskin (2005) proposes a clear-oriented knowledge management strategy whereas Swan and others (2000) lean toward the tacit-oriented knowledge management strategy. Furthermore, Pai (2005) tends to assess the effectiveness using internal knowledge while Bierly and Chakrabarti (1996) take an approach based on external knowledge strategy. In general, the source of knowledge management strategy comes from a range of internal and external knowledge which are reflection of tacit and explicit knowledge. Obviously, these two facets play a vital role between knowledge management strategy and organizational performance.

The intensity of impact of knowledge management strategy on organizational performance is yet to be determined. The theorists and the pragmatists still hold conflicting views on knowledge management strategy because of their inconclusive complexity. Bierly and Chakrabarti (1996) maintain a viewpoint that the complementarity of knowledge management strategy does have positive effects on organizational performance. Other authors may disagree. The classification of knowledge management strategy will still remain a topic for discussion because of the non-complementarity. Since the test results will be deeply affected by the interaction among the knowledge management strategy, this topic has attracted many researchers' attention and devotion. In previous studies, only financial performance is considered when it comes to the relation between non-complementary knowledge management strategy and organizational performance, e.g. return on asset (ROA) and return on equity (ROE) (Pai, 2005). Major efforts should be made in the future to create new guidelines like "innovation" and others as a valuable reference for the managers.

3. Research methods
3.1 Research Framework

Based on its motivation and purpose, this study has constructed a framework as shown in Figure 2. This diagram designates the "four dimensions of knowledge management strategy" as "independent variables", and the "organizational performance" as "dependent variable". This study will try to analyze the impact of independent variables on dependent variable.
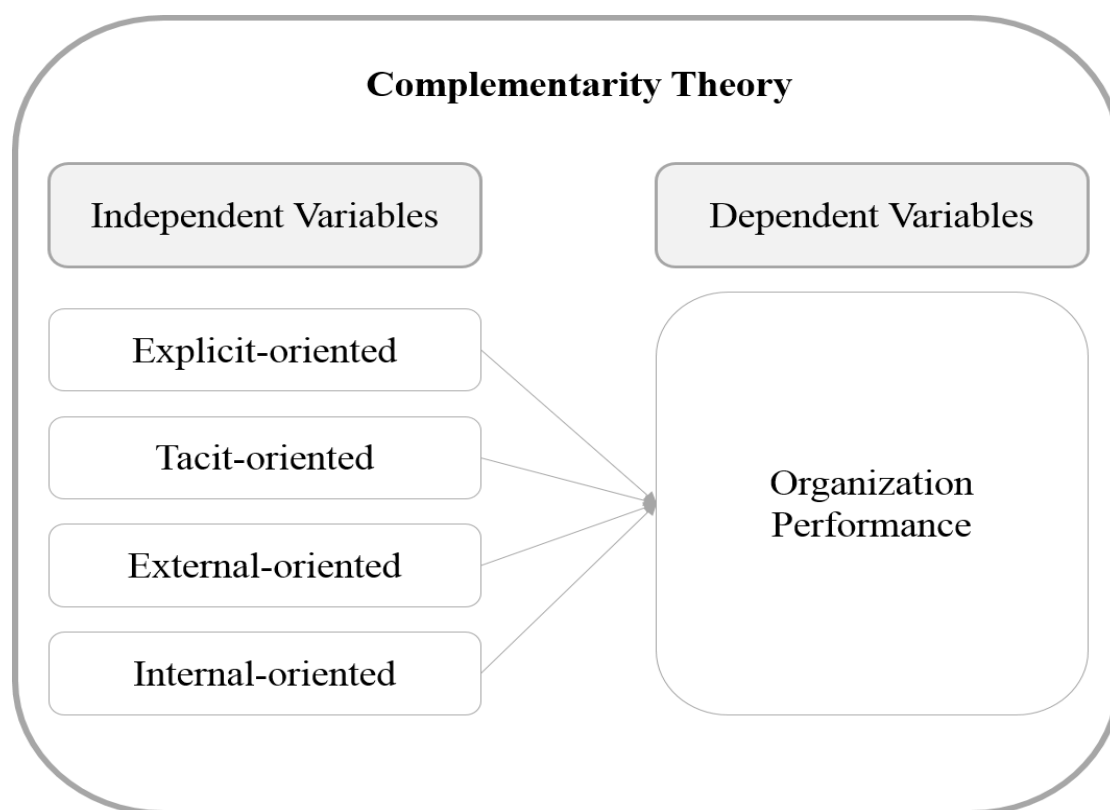

Figure 2. Research framework.

3.2 Research Process

As shown in Figure 3, a flowchart is drawn to distinguish the step-by-step process of this study.   First, the Preparation Stage is constituted of four steps: the motivation and purpose of the study, the collection and collation of pertinent publication, setup of research framework and finally the translation. Then, questionnaires are collected and analyzed, hypotheses are drawn and tested, and last, conclusions and recommendations are presented.
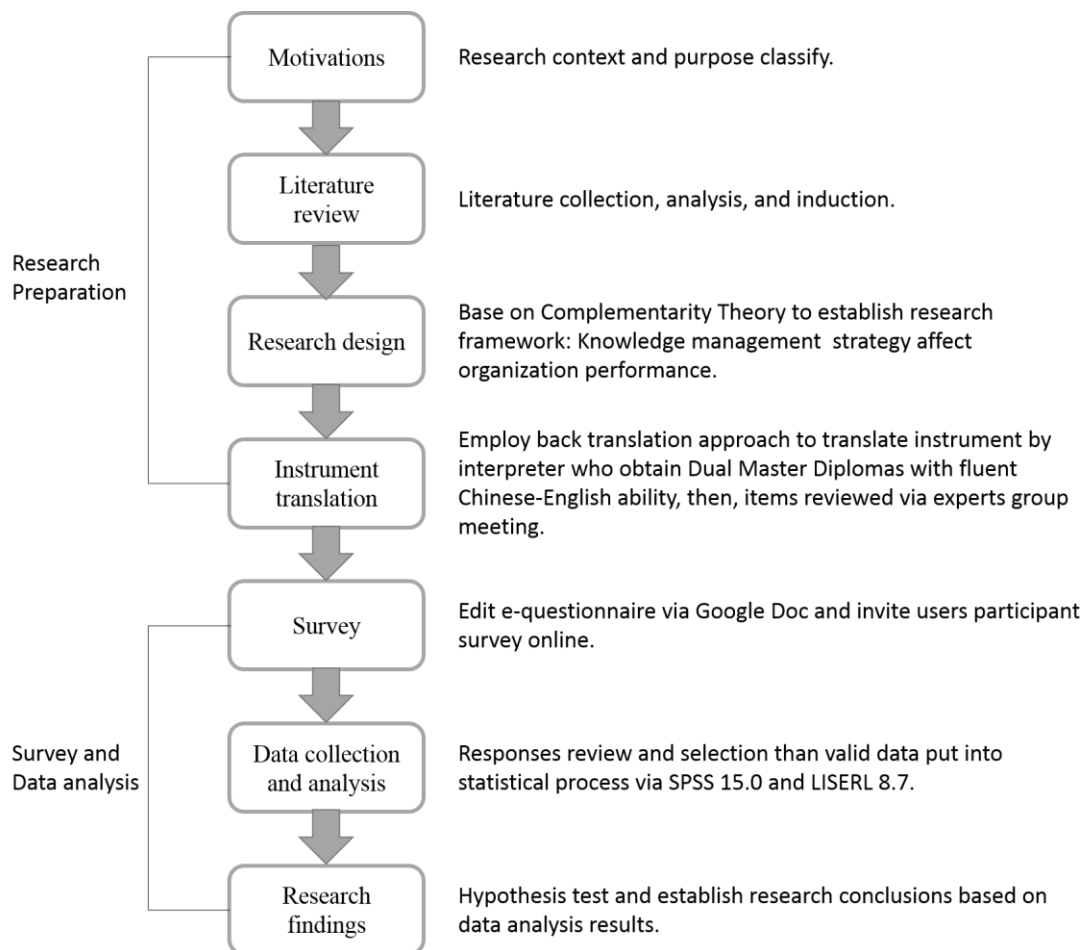

Figure 3. Procedure

3.3 Data Analysis

The statistical-specialty software SPSS 15.0 version is implemented.   Software LISREL 8.71 version is subsequently used for its capability to work on structural equation modeling.

3.3.1 Development of the Questionnaires

Choi et al. (2008) have come up with their "Questionnaires of Knowledge Management Strategy and organizational performance" after reviewing relevant literature, analyzing and compiling available information. The questionnaires are targeted at mid-level management from 900 companies registered in the Korea open stock market.   The subjects are chosen for their managerial position held in knowledge management and for

their understanding of such area.   A total of 131 questionnaires are collected and of them, 115 are considered valid after certain screening process. Choi et al. (2008) have adopted three parameters for their questionnaires: factor analysis, cluster analysis and correlation analysis.

Two dimensions are intertwined with each other in the questionnaires.   They are "knowledge management" dimension and "organization performance" dimension. (Deshpande, Jarley & Webster, 1993). Knowledge management dimension can be further divided into four sub-dimensions: 1. explicit-oriented degree (Choi & Lee, 2003), 2. Tacit-oriented degree (Choi & Lee, 2003), 3.nexternal-oriented (Lee et al, 1999), 4. Internal-oriented (Lee et al, 1999).   With the addition of Corporate Performance Dimension (Deshpande et al, 1993; Drew 1997), a total of 24 questions are produced. Amabile, Conti, Coon, Lazenby and Herron (1996) have adopted Likter's six-point scale system to eliminate ambiguous answers such as "neutral". The Likter's six-point scale assigns a range of one to six points to each corresponding answer on a gradual scale.   The answers to choose from are: "totally disagree", "mostly disagree", "disagree", "agree", "Mostly agree" and "totally agree".

This study uses "Questionnaires of knowledge management strategy and organizational performance" by Choi et al. (2008) as a basis to conduct our examination on their theory framework.   Following the viewpoints on scale path method brought forward by Farh et al. (2006), this study has decided to translate the questionnaires directly from English into Chinese without changing its content. The original questions are first translated into Chinese by a UK bi-master holder with excellent bi-lingual competence.   And then our team have met twice in an effort to cross-examine, then correct anything lost in the Sino-English translation therein. This is done to eliminate and correct any misunderstanding caused by bias out of different cultures. Thereafter, the Chinese version of questionnaires is loaded onto a computer for compilation and survey.

3.3.2 Surveying the Questionnaires

To meet the demand for accuracy and speed in modern research, and to minimize the time and space limitations and the possible coding errors, this study has set up an electronic platform on Google Doc to conduct its questionnaire   process. It is a big advantage of this network system that the input can be done online anywhere and anytime without bothering with time and place problems.   The input is then saved immediately without the possibility of delay and/or coding errors as commonly seen in a manual operation.

Having finished "Questionnaires of knowledge management strategy and organizational performance", the team start sending e-mails using "convenience sampling" method to personnel in public and private sectors. The time span to answer is 11 days, from October 11 to 29, 2009. At the closure, 94 valid samples are collected from the preliminary data.

3.3.3 Reliability test

There is a slight difference between this study and Choi et al. (2008) with regard to the verification of the reliability of the test scale, as shown in Table 4 below:

Table 4. Reliability Coefficients Comparative Summary

Factors	Items	Cronbach's α value of Choi et al. (2008)	Cronbach's α value of current data
Knowledge management focus			
tacit-oriented	4	.676	.892
explicit-oriented	4	.781	.856
Knowledge management resources			
external-oriented	5	.702	.740
Internal-oriented	6	.894	.940
Organizational performance	5	.857	.903
Samples	--	115	94

Choi et al. (2008) have obtained 115 valid questionnaire samples versus 94 received by this study, a difference of 21 between the two. In addition, the values of reliability coefficients of Choi et al. (2008) range from .676 to .894 while this study's fall between .740 and .940.

In this study, the "resources: external-oriented" ranks lowest (Cronbach's α is .740) and "resources: internal-oriented" has the highest value (Cronbach's α is .940). On the other hand, among all dimensions of Choi et al. (2008), "focus on knowledge management: tacit-oriented" shows a lowest value of .676, with "resources of knowledge management: internal-oriented" having the highest value of .894. In the book "Psychometric Theory", Nunnally (1978) believes that the Cronbach's α value needs to be more than .70 for a dimension to be regarded reliable in most studies. George and Mallery (2003) hold the same view. Based on the above assertions, there should be no question of the reliability of this research.

This study also refers to a Formula (Fornell & Larker, 1981) to compute its "Composite Reliability" of latent variables:

$$\rho c = (\Sigma \lambda i)^2 / [(\Sigma \lambda i)^2 + \Sigma \Theta ii] \qquad \text{(Formula 1)}$$

$(\Sigma \lambda i)^2$: Sum square of factor loading

$\Sigma \Theta ii$: Sum of observed variables and residuals

The results of $(\Sigma \lambda i)^2 = 211.702$; $\Sigma \Theta ii = 7.53$ are produced through computation and then loaded into the formula to produce a XX value of .966. Chiou (2008) deems that the classical theories require a minimum of .70 reliability coefficient for the measurement. However, Bagozzi and Yi (1998) hold a compromising view that it's impractical for social science studies to reach a .70 level so .60 is sufficient enough for reliability test. Raine-Eudy (2002) even accept .50 value for its ample stability. With the Cronbach's α value higher than .70 for all dimensions and the composite reliability coefficient reaching an astonishing .966, it is safe to say that this study has demonstrated a good evidence of reliability.

3.3.4 Validity test

(1) Construct Validity

Campbell and Fiske (1959) propose the use of "multitrait multimethod matrix" for the purpose of measuring "convergent validity" and "discriminant validity" Convergent validity refers to the use of two different measures for an individual constructs. The constructs are interrelated to each other. Discriminant

validity refers to one measure for two dissimilar constructs. One should be able to discriminate between dissimilar constructs. (Parasuraman, Zeithaml & Malhotra, 2005) This study uses LISREL 8.71 version, a software specializing in structural equation modeling, to conduct the estimate of parameters using "maximum likelihood" approach. After 14 times of computation on matrix, the outcome shows degrees of convergence which will be served as an examination tool of "fit" conditions and indications of validity.

(a) Convergent Validity

The numbers in Figure 5 show every observed variable with regard to factor loading, standard variation and t value. Factor loading is the explained variation from latent variables. The study outcome shows a wide range of values between .34 and .90 with the lowest score (.34) for question X11 versus the highest (.90) for questions X16 and X17. Hair et al. (2006) think that a sufficient factor loading value is an indication of high degree of convergence of the items. Table 5 shows specific criteria for factor loading set forth by Tabachnick and Fidell (2007). They also believe that it would be an ideal situation when factor loading value is greater than .71 and this explains 50% of the variation.

Table 5. Standardized Factor Loading, Standard Error and t Value Summary (N=94)

Factors	Measure Variables	Factor Loading	Standard Error	t Value
Explicit-oriented	X1	.74	—*	—*
	X2	.88	.15	8.46
	X3	.81	.18	7.79
	X4	.86	.15	8.26
Tacit-oriented	X5	.80	—*	—*
	X6	.79	.13	7.94
	X7	.79	.13	7.99
	X8	.72	.13	7.19
External-oriented	X9	.74	—*	—*
	X10	.77	.14	6.60
	X11	.34	.14	3.00
	X12	.58	.12	5.06
	X13	.62	.14	5.47
Internal-oriented	X14	.84	—*	—*
	X15	.86	.09	10.63
	X16	.90	.09	11.41
	X17	.90	.09	11.45
	X18	.82	.10	9.89
	X19	.79	.09	9.17

Note: —* means that parameter fixed at 1.00.

The multi-scales designed in social science study are, by their nature, confined to a certain degree. A survey on "attitude" may be too vast to be specific. Concept cannot be easily defined due to its ambiguity. There may also be outside interference, errors in measuring or controversy in construct itself. Chiou (2008) regards it a decent convergence if the factor loading value is greater than .55 ($\lambda 2 \geqq 30\%$). Accordingly, a "fair or above" mark can be given to this study since all but one (X11: λ=.34, in poor convergence) factor loading values exceed λ>.55.

In reference to the relation between observed variables and their corresponding latent variables, Bagozzi

and Yi (1988), and Anderson and Gerbing (1988) believe that, if every t value for the observed variables is greater than 1.96 (p<.05), correlation between the two variables can be established and served as an evidence of convergent validity (Kline, 2005). The results of this analysis have demonstrated all t values to be greater than 1.96 (Table 6) to conclude the fact that the two types of variables are indeed correlated as the evidence of convergent validity.

Table 6. Standardized Factor Loading, Factor Loading Square and Judgment Summary

Factor loading (λ)	Factor loading square (λ^2)	Judgment
.71	50%	Excellent
.63	40%	Very good
.55	30%	Good
.45	20%	Fair
.32	10%	Bad
$\leq$ .32	$\leq$ 10%	Denied

Resource: Tabachnick & Fidell (2007).

(b) Discriminant Validity

Discriminant validity is determined by assigning a correlation coefficient value of "1.0" to two latent constructs, finding the difference of χ^2 value between fit model and single model in proportion to their discriminant validity (Bollen, 1989). This study uses χ^2 difference to examine discriminant validity. The χ^2 value greater than .384 (α=.05) is an evidence of discriminant validity (Kline, 2005). An examination of Table 7 shows that the χ^2 values of coupled constructs fall between 7.29 ~ 10.69, far exceeding the required value of .384. Thus an indication of good discriminant validity for this study.

Table 7. Correlation parameters Summary (N=94)

Factors	Explicit-oriented	Tacit-oriented	External-oriented	Internal-oriented
EOD	—			
TOD	7.57	—		
ExO	7.29	8.98	—	
InO	8.60	10.69	8.61	—

(c) Model Fit

Four dimensions of knowledge management models are selected by this study as in Figure 4. Questions/items are assigned to them: four for explicit-oriented; four for tacit-oriented; five for external-oriented and six for internal-oriented for a total of 19.

The summary of model fit test is hereby shown in Table 8. First, the degree of freedom χ^2/df=2.04 has met the criteria whereas χ^2= 297.06 has failed the test. In reference to model fit, NFI (.91$\geqq$.90), PGFI (.58$\geqq$.50) and IFI (.95$\geqq$.90), appear to have met the criteria set forth. Contrarily, GFI (.75$\geqq$.90) and ASFL (.67$\geqq$.90), have failed to do so.
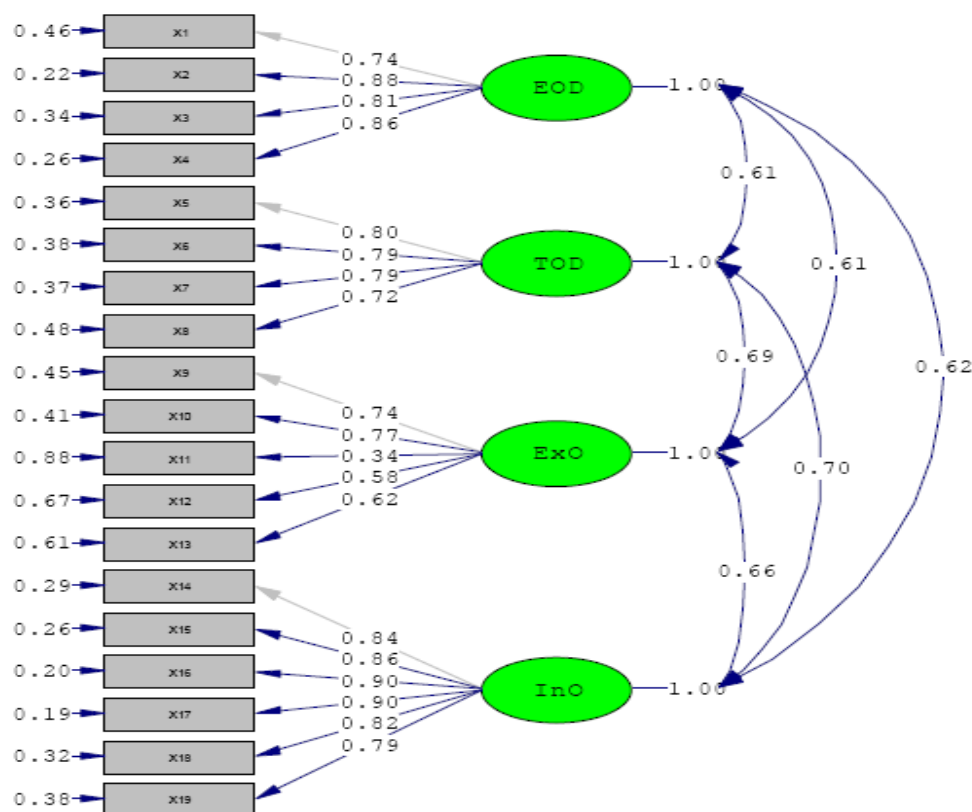
Chi-Square=297.06, df=146, P-value=0.00000, RMSEA=0.105

Figure 4. Confirmatory factor analysis results with parameters of standardized factor loadings, correlations and residuals

The above results of model fit are an indication that there is room for improvement for the research team in the area of the selection of research tools, the content of questionnaires, etc.

Table 8. Model Fit Examination Criteria and Results of Confirmatory Factor Analysis (N=94)

Model Fit Indicators	Parameters	Criteria	Results
1. Chi-square test			
χ^2(Chi-square)	297.06 (p<.000)	p > .05 (Chiou, 2008)	Fail
$\chi^2/$ df (degree of freedom)	2.04	≤ 3 (Wheaton et al., 1977)	Pass
2. Goodness-of-fit index			
GFI (Goodness-of-fit)	.75	≥ .90 (Bentler, 1983)	Fail
AGFI (Adjusted GFI)	.67	≥ .90 (Bentler, 1983)	Fail
NFI (Normed fit index)	.91	≥ .90 (Bentler & Bonett, 1980)	Pass
NNFI (Non-normed fit index)	.94	≥ .90 (Bentler & Bonett, 1980)	Pass
PGFI (Parsimonious	.58	≥ .50	Pass

goodness-of-fit index)			(Mulaik, 1989)	
IFI (Incremental fit index)	.95		≥ .90 (Yu, 2006)	Pass
3. Comparative fit index				
CFI (Comparative fit index)	.95		≥ .90 (Bentler, 1988)	Pass
RMSEA (Root-mean-square error of approximation)	.11		≤ .50 (Browne & Cudeck, 1989)	Fail
4. Residuals analysis				
RMR (Root-mean-square residual)	1.49		≤ .05 (Yu, 2006)	Fail
SRMR (Standardized RMR)	.072		≤ .05 (Yu, 2006)	Fail

4. Analyze Results and Discussions

4.1 Descriptive Statistical Analysis

This study uses Google Doc as an electronic platform to post questionnaires and answers online Background information from collected data for each individual is fed into computers and examined afterwards. Following is the descriptive statistical analysis of 94 subjects based on the distribution situation and percentage as shown in Table 9.

Table 9. Demographic variables Summary (N=94)

Items	Groups	Samples	Percentage	Missing Value
Gender	Female	44	46.8	0
	Male	50	53.2	
Age	16-22 years old	2	2.1	2
	23-29 years old	37	39.4	
	30-36 years old	39	41.5	
	37-43 years old	11	11.7	
	44-50 years old	2	2.1	
	Over 51 years old	1	1.1	
Education Level	Under high school	10	10.6	0
	Some college	12	12.8	
	Bachelor	61	64.9	
	Master	11	11.7	
	Doctor	0	0	
Position	Operator	8	8.5	1
	Coordinator	1	1.1	
	Engineer	43	45.7	
	IT staff	27	28.7	
	Supervisor	0	0	
	Manager	9	9.6	
	Top manager	2	2.1	
	Representative	3	3.2	
Company history	Under 1 year	1	1.1	1
	1-3 years	5	5.3	
	4-5 years	8	8.5	
	6-5 years	9	9.6	
	11-15 years	19	20.2	
	16-20 years	11	11.7	
	Over 21 years	40	42.6	
Organization	Under 10 staffs	9	9.6	3

Items	Groups	Samples	Percentage	Missing Value
scale	11-30 staffs	9	9.6	
	31-50 staffs	5	5.3	
	51-100 staffs	10	10.6	
	101-500 staffs	25	26.6	
	501-1000 staffs	10	10.6	
	Over 1,001 staffs	23	24.5	
	Under 1 year	9	9.6	0
	1-3 years	35	37.2	
	4-5 years	16	17.0	
Seniority	6-5 years	17	18.1	
	11-15 years	9	9.6	
	16-20 years	8	8.5	
	Over 21 years	9	9.6	
Seniority of	Never	29	30.9	2
knowledge	Under 1 year	8	8.5	
management	1-3 years	11	11.7	
executive	4-5 years	9	9.6	
	Over 6 years	35	37.2	

The statistics of this study shows a gender survey outcome of 50 (53.2%) samples from males with 44 (46.8%) from females. There are more male respondents than female. Data also point out the predominantly high percentage (41.5%) for age group 30-36 and the lowest percentage (1.1%) for age group 51 and over, a demonstration that most respondents are young men and women who entered the job market not too long ago. As to the educational level, statistics shows that the majority of the respondents (64.9%) have a bachelor's degree. And the percentage is lowest (10.6%) for workers with only high school/vocational high school diploma and below. Most respondents are college graduates and/or above. In checking the job/capacity background, engineers no doubt hold the highest percentage (45.7%) while production line supervisors have the least percentage (1.1%). With regard to the history of the organization, 40 respondents (42.6%) come from companies with at least 21 years of history. Only one person (1.1%) holds a job from a company less than a year old. So the descriptive statistical analysis indicates that most respondents come from organizations at least 21 years old, and the least for less than a year. In reference to the size of the organization in terms of the number of the employees, 25 (26.6%) respondents are employed by the 101-500 employee strong organizations whereas 5 (5.3%) are from 31-50 employee organizations. Descriptive statistical analysis hereby shows most respondents for 101-500 employee organizations, least for 31-50 employees. By combining the two background check items of organizational history and organization size, we can infer that most respondents are hired by well-developed medium-sized enterprises. The seniority survey shows a 35 (37.2%) respondents with 1-3 years of service versus 8 (8.5%) respondents with 16-20 years of service. This is an indication that most respondents are still quite new with their organizations. Last, with regard to the number of years an organization implements knowledge management, 35 (37.2%) respondents work for organizations with more than six years of experience in that while 8 (8.5%) work for organizations with experience less than a year. This concludes the fact most respondents belong to organizations with at least six years of experience in promoting knowledge management.

4.2 Model Examination

4.2.1 Model Fit

This study has summarized the criteria and results of the model fit test as shown in Table 10. First, the χ^2/df score of 1.99 (χ^2/df=1.99) for the degree of freedom of this study has met the test criteria but Chi-squared (χ^2=482.48, p<.000) test has failed.　Moreover, test results on PGFI (.56≧.50), NFI (.90≧.90), NNFI (.93≧.90) and IFI (.94≧.90), have shown passing grades for them. Contrarily, test scores of GFI (.75≧.90) and AGFI (.63≧.90), have failed to meet their predetermined index requirements. In the substitution part, results of CFI (.94≧.90) have passed, not so for the RMSEA (.10≧.50). Last, in the category of residuals analysis, neither RMR (1.49>.05) nor SRMR (.072>.05) has passed the test. The above results suggest that knowledge management strategies correlate with organizational performance to a certain degree. Therefore, it is essential to find out the intricate interactions and interrelation among the various knowledge management strategies and their impact on organizational performance.

Table 10. Research Model Examination Criteria and Results of Confirmatory Factor Analysis (N=94)

Model Fit Indicators	Parameters	Criteria	Results
1. Chi-square test			
χ^2(Chi-square)	482.48 (p<.000)	p > .05 (Chiou, 2008)	Fail
χ^2/ df (degree of freedom)	1.99	≤ 3 (Wheaton et al., 1977)	Pass
2. Goodness-of-fit index			
GFI (Goodness-of-fit)	.75	≥ .90 (Bentler, 1983)	Fail
AGFI (Adjusted GFI)	.63	≥ .90 (Bentler, 1983)	Fail
NFI (Normed fit index)	.56	≥ .50 (Mulaik et al., 1989)	Pass
NNFI (Non-normed fit index)	.90	≥ .90 (Bentler & Bonett, 1980)	Pass
PGFI (Parsimonious goodness-of-fit index)	.93	≥ .90 (Bentler & Bonett, 1980)	Pass
IFI (Incremental fit index)	.94	≥ .90 (Yu, 2006)	Pass
3. Comparative fit index			
CFI (Comparative fit index)	.94	≥ .90 (Bentler, 1988)	Pass
RMSEA (Root-mean-square error of approximation)	.10	≤ .50 (Browne & Cudeck, 1989)	Fail
4. Residuals analysis			
RMR (Root-mean-square residual)	1.65	≤ .05 (Yu, 2006)	Fail
SRMR (Standardized RMR)	.077	≤ .05 (Yu, 2006)	Fail

In an effort to analyze the impact of knowledge management strategy on organizational performance, structural equation models are adopted by this study as shown in Figure 5. After examining the complementarity of the four dimensions of knowledge management strategy, namely explicit-oriented, tacit-oriented, external-oriented and internal-oriented, with organizational performance, it is discovered that the effects of

explicit-oriented dimension (EOD), tacit-oriented dimension (TOD) and external-oriented dimension (ExO) do not correlate significantly with corporate performance (CP). Only internal-oriented dimension (InO) is able to produce a direct impact on corporate performance (CP) (β=4.68; p<.05).
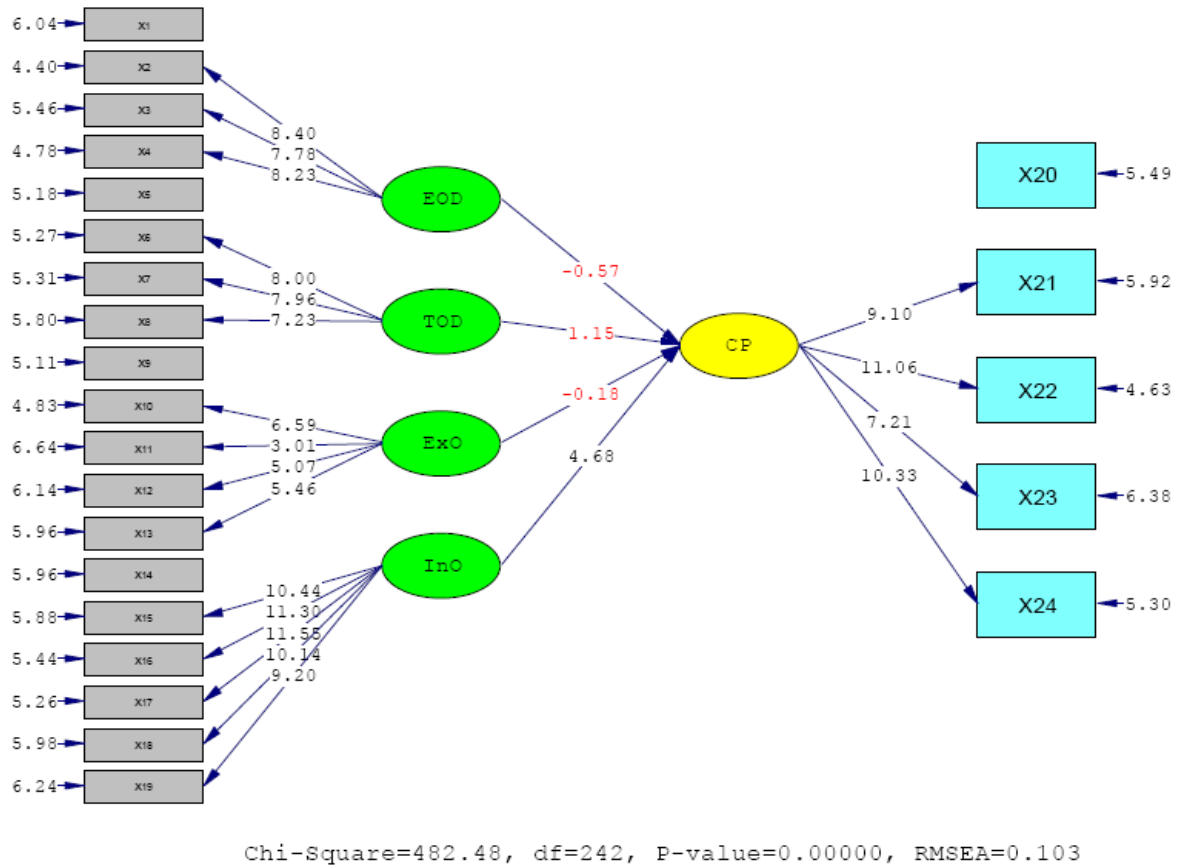

Chi-Square=482.48, df=242, P-value=0.00000, RMSEA=0.103

Figure 5. Research model with parameters of standardized factor loadings, correlations and residuals

5. Conclusions and Recommendations

5.1 Research conclusions

The reliability test on research tools of this study is based on the standards set up by Nunnally (1978), Fornell and Larker (1981), and Tabachnick and Fidell (2007). The coefficient values of this research are measured to be greater than .70 for every dimension, showing a better reliability than that of Choi and others (2008). Regarding the establishment of the validity of this study, the criteria provided by Bagozzi and Yi (1988), and Anderson and Gerbing (1988) are adopted as a guidance. Accordingly, the results produced through our questionnaires prove to be dependable in both reliability and validity.

On the other hand, the results from Choi and others (2008) shows that explicit-oriented strategy is correlated with corporate performance and tacit-oriented is not. With regard to external-oriented and internal-oriented strategy, they both have a substantial impact on corporate performance. Based on the above, explicit-oriented, external-oriented and internal-oriented strategies do present a complementary correlation with the organizational performance; accordingly, the better application of knowledge management strategy, the

better performance for a corporation. However, the coefficient analysis of this study through structural equation modeling procedures reveals that the application of explicit-oriented, tacit-oriented and external-oriented knowledge management strategy does NOT have a significant effect on organizational performance. In conclusion, based on the sample collected in Taiwan area, only internal-oriented knowledge management strategy is considered complementary with organizational performance. This is to say, a proper implementation of the internal-oriented knowledge management strategy will have a beneficial effect on organizational performance.

5.2 Recommendations

5.2.1 Academic implications

The analyzed results of this research clearly confirm the establishment of reliability and validity of the research tool" Questionnaires on knowledge management strategy and organizational performance", and through that, the reliable measurements and evaluation of organization members' perception of the questionnaires and other issues have been accomplished. In addition, viable models are constructed with the help of structural equation modeling process. Although reinforcement is required in the area of model fit test, the research tool of this study still proves to be effective in measuring the complementary correlation between knowledge management strategy and organizational performance.

In view of the above, it is suggested that the research tool in this study, for its academic merits, should be a good measurement tool for this kind of study in the Chinese inhabited area.

5.2.2 Practical implications

For all practical purposes, the research results derived from samples in Taiwan do indicate that "Internal-oriented knowledge management strategy is complementary with organizational performance". As an inference, the proper implementation of internal-oriented knowledge management strategy will definitely improve organizational performance. Further, the internal knowledge in organization members' brain is a vital resource for the development of the organization. An organization should devote itself to turning its members' brain power into new knowledge rather than try to seek it outside.

It is therefore suggested that an organization needs to utilize its internal knowledge more frequently in order to stress the importance of it, to build a sense of trust among the members when sharing it, to improve the usefulness of it, to intensify its predominance, for the purpose of creating new knowledge. Internal knowledge, if highly valued and developed by the management, will surely create the benefit of improving organizational performance which results from the complementarity between the two. The benefit could be a breakthrough in new product development and/or some ingenuity of new service.

5.3 Recommendations for future study

Four recommendations are proposed by this research as a reference for future study.

1. The number of valid questionnaires collected is limited to 94. It is recommended for future study that a minimum sample size of 200 is necessary (Chiou, 2008) to accommodate the sample size requirements of

structural equation modeling.

2. A greater effort should be made in the future study to modify the models.   Optimum procedures are followed for the model amendments as well as an in-depth adjustment of the theory framework.

3. The factor loading value of .34 on X11 in Table 5 is shown as being "poor". An amendment to this observed variable is recommended.

4. The "convenience sampling" method is adopted in this study. It is recommended that the sampling in the future study should be targeted at mid-level and top managers for much more accuracy.

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